Quarter Exam Review:

Exam Tuesday, 10/18

- 1-D motion:
  - Graphing
  - Falling objects $a_y = a_g = 9.8\ m/s^2$
  - Equations:

$$\bar{v} = \frac{\Delta \bar{x}}{\Delta t}$$

$$\bar{a} = \frac{\Delta \bar{v}}{\Delta t}$$

kinematics eqns.:

$$\Delta x = v_{ix}t + \frac{1}{2}a_x t^2$$

$$v_{fx}^2 = v_{ix}^2 + 2a_x \Delta x$$

$$v_{fx} = v_{ix} + a_x t$$

For y-direction, substitute y's for x's

- 2-D motion → projectile motion
  - Use kinematics equations in both directions
  - Conditions:
    - No acceleration in the x-direction
    - Object is in free-fall

- Forces
  - Newton's laws
  - Types of forces
  - Problem types
  - Equations:

$$\Sigma \bar{F} = m\bar{a}$$

$$F_f = \mu F_N$$

  - Free-body diagrams
- Momentum
  - Impulse-momentum theorem
  - Conservation of momentum
  - Collisions
    - Perfectly elastic
    - perfectly inelastic
  - Equations:

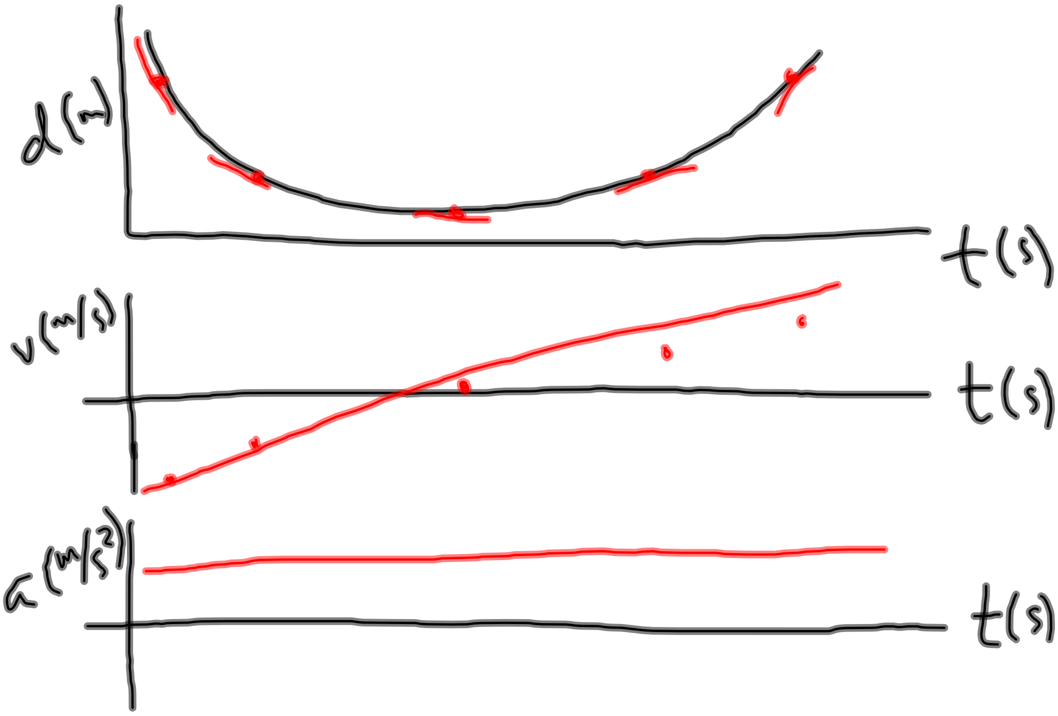
$$\bar{F}\Delta t = m\Delta\bar{v}$$

$$m_1\bar{v}_{1i} + m_2\bar{v}_{2i} = m_1\bar{v}_{1f} + m_2\bar{v}_{2f}$$

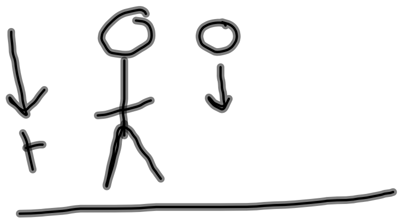
$$(m_1 + m_2)\bar{v}_i = m_1\bar{v}_{1f} + m_2\bar{v}_{2f}$$

$$m_1\bar{v}_{1i} + m_2\bar{v}_{2i} = (m_1 + m_2)\bar{v}_f$$

Change the following shape on the d v. t graph into shapes on v v. t and a v. t graphs.



Jason drops a volleyball from 2.0 m above the floor. How long will it take before the ball hits the ground?



$v_i = 0\ m/s$ $\quad a_g = 9.8\ m/s$

$v_f = ?$ $\quad t = ?$

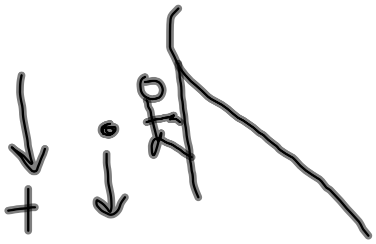
$\Delta y = 2.0\ m$

$$\Delta y = \cancel{v_{iy} t}^{\,0} + \frac{1}{2} a_g t^2$$

$$t = \sqrt{\frac{2\Delta y}{a_g}}$$

$$= 0.64\ s$$

A small first-aid kit is dropped by a rock climber who is descending steadily at 1.3 m/s. After 2.5 s, what is the velocity of the first-aid kit, and how far is the kit below the climber if the climber comes to a stop just after he drops it?



$v_i = 1.3\ m/s$ $\quad \Delta y = ?$

$v_f = ?$ $\quad a_g = 9.8\ m/s^2$

$t = 2.5\ s$

a) $v_f = v_i + a_g t$

$= 1.3\ m/s + (9.8\ m/s^2)(2.5\ s)$

$= 25.8\ m/s$

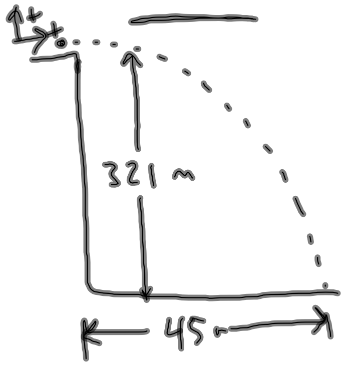
b) $\Delta y = v_{iy} t + \frac{1}{2} a_g t^2$

$= (1.3\ m/s)(2.5\ s) + \frac{1}{2}(9.8\ m/s^2)(2.5\ s)^2$

$= 33.9\ m$

Quarter Exam Notes and Practice Problems 4th Block 10.14.11

The Royal Gorge Bridge in Colorado rises 321 m above the Arkansas River. Suppose you kick a rock horizontally off the bridge. The magnitude of the rock's horizontal displacement is 45.0 m.
a) Find the speed at which the rock was kicked.
b) Find the final velocity the rock has just before it hits the ground.



$\Delta x = 45\ m$ $\quad v_{fx} =$

$\Delta y = -321\ m$ $\quad v_{fy} =$

$v_{ix} = ?$ $\quad v_f =$

$v_{iy} = 0\ m/s$ $\quad a_x = 0\ m/s^2$

$t = ?$ $\quad a_g = -9.8\ m/s^2$

a) $\Delta y = v_{iy}t + \frac{1}{2}a_g t^2$ ($v_{iy}t \to 0$)

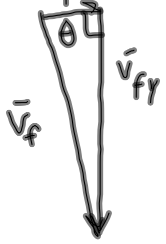
$$t = \sqrt{\frac{2\Delta y}{a_g}} = \sqrt{\frac{2(-321\ m)}{(-9.8\ m/s^2)}} = 8.09\ s$$

$\Delta x = v_{ix}t + \frac{1}{2}a_x t^2$ ($\frac{1}{2}a_x t^2 \to 0$)

$$v_{ix} = \frac{\Delta x}{t} = \frac{45\ m}{8.09\ s} = 5.56\ m/s$$

b) $v_{fx} = v_{ix} = 5.56\ m/s$

$$v_{fy} = v_{iy} + a_g t = (-9.8\ m/s^2)(8.09\ s)$$
$$= -79.3\ m/s$$



$$v_f = \sqrt{v_{fx}^2 + v_{fy}^2}$$
$$= 79.5\ m/s$$

$$\theta = \tan^{-1}\left(\frac{v_{fy}}{v_{fx}}\right)$$
$$= 86°$$

$\bar{v}_f = 79.5\ m/s$ @ $86°$ S of E